Notice of Allowability	Application No.	Applicant(s)
	09/944,104	POROTSKY, SERGEY
	Examiner	Art Unit	
	Jeffrey C. Pwu	2143	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to _3/4/05 Amendment; 5/18/05 Interview_.

2. ☒ The allowed claim(s) is/are _1 and 4-13_.

3. ☒ The drawings filed on _17 May 2005_ are accepted by the Examiner.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a) ☐ All   b) ☐ Some*   c) ☐ None   of the:

      1. ☐ Certified copies of the priority documents have been received.

      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .

      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

    * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application. **THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.

    (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached

      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____ .

    (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of

    Paper No./Mail Date _____ .

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)

2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)

3. ☒ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _3/21/05; 10/19/04_

4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material

5. ☐ Notice of Informal Patent Application (PTO-152)

6. ☒ Interview Summary (PTO-413), Paper No./Mail Date _5/20/05_ .

7. ☒ Examiner's Amendment/Comment

8. ☒ Examiner's Statement of Reasons for Allowance

9. ☐ Other _____ .

JEFFREY PWU
PRIMARY EXAMINER

EXAMINER'S AMENDMENT

1.   An examiner's amendment to the record appears below. Should the changes and/or

additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR

1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the

payment of the issue fee.

        Authorization for this examiner's amendment was given in a telephone interview with

Ms. Ronni S. Jillions on May 19, 2005.

2.   The specification has been amended as follow:

        On page 4, line 4, "ATM networks" has been replaced with "Asychronous Transfer Mode

(ATM) network".

3.   The claims has been amended as follows:

        1. A method for selecting an optimal path in an Asychronous Transfer Mode (ATM)

network having a plurality of links where, for each of the links, Link State Parameters are

defined including a group of non delay-oriented (non-D) parameters comprising at least

Administrative Weight (AW) and two delay oriented parameters (D-parameters) being

Maximum Cell Transfer Delay (MaxCTD) and Cell Delay Variation (CDV), the method being

performed by the following steps:

a) obtaining two limitations of end-to end quality of service (QoS) parameters of a path to be selected between a source point and a destination point in said network, one of the limitations being Maximum Cell Transfer Delay $(MaxCTD_{QoS})$ and the other limitation being CDV_{QoS},

b) normalizing a D-parameter CDV by virtually modifying the ATM network so as to make CDV constant for all links of the modified network, by

selecting a value of minCDV such, that values of CDV parameter of the network links are substantially represented as respective k-fold multiples of said minCDV, where k is integer;

building a modified network by symbolically replacing each of the links, having CDV value of k*minCDV where k>1, with "k" fictitious component links each having the CDV value equal to said minCDV so, that the CDV value of each replaced link be equal to a cumulative value of corresponding CDV values of the "k" fictitious component links;

assigning to said "k" fictitious links values of remaining Link State Parameters in a manner providing equivalence of said "k" links to the replaced link from the point of each of the link state parameters;

c) constructing a link cost equation comprising a first member reflecting influence of a D-parameter MaxCTD on the cost, and a second member reflecting influence of the group of non-D parameters on the cost, the members being taken with respective relative importance weights, wherein a relative importance weight of the member associated with said D-parameter MaxCTD is defined as R, and a relative importance weight of the member associated with the non-D parameters is defined as (1-R);

d) based on said link cost equation, calculating links' costs of the modified network, for one or more values of a ratio between the relative importance weight of the first member and that of the second member, and forming a data base of link costs for each of said one or more ratio values;

e) applying a Bellman-Ford-type shortest path algorithm to each of the formed data bases to determine one or more conditional paths for the respective one or more data bases, said algorithm being capable of selecting a minimal cost path among paths limited by a given number of links to satisfy said limitation CDV_{QoS};

f) calculating one or more cumulative values $MaxCTD_{cum}$ of the D-parameter MaxCTD for said respective one or more determined conditional paths, and

g) making a judgment about the optimal path, based on comparing said one or more cumulative values $MaxCTD_{cum}$ with the limitation $MaxCTD_{QoS}$, said optimal path being such of said one or more determined conditional paths, satisfying both the limitation CDV_{QoS} and the limitation $MaxCTD_{QoS}$.

2. (cancelled)

3. (cancelled)

4. The method according to Claim 1, wherein the step of calculating links' costs of the modified network further comprises:

sequentially selecting one or more <u>variable values</u> R in the range $0<R<1$ and calculating

for each of them link costs of all the links of the modified network using said link cost equation,

and

forming a data base of link costs for each of said one or more R values.

5. The method according to Claim 1, wherein the step (e) comprises:

applying the Bellman-Ford-type shortest path algorithm to each of the data bases, for

defining said conditional shortest path between the source point and the destination point, while

limiting a number of links in said path to $H = CDV_{QoS}/minCDV$, thereby obtaining the

conditional shortest path both having a minimal sum of the cost values of links forming said

path, and satisfying the end-to-end limitation CDV_{QoS}.

6. The method according to Claim 1, wherein the step of calculating the cumulative value

$MaxCTD_{cum}$ of the D-parameter MaxCTD for each of said conditional shortest paths comprises

summing MaxCTD values of the links forming said path.

7. The method according to Claim 1, wherein the judgement about the optimal path is

performed by

comparing said one or more cumulative values $MaxCTD_{cum}$ with the limitation $MaxCTD_{QoS}$,

checking whether there exists a particular value $R*$ of the relative importance weight R at which

the determined conditional shortest path has the cumulative value $MaxCTD_{cum}$ equal to, or

smaller but substantially close to said $MaxCTD_{QoS}$ limitation,

if yes, the conditional shortest path determined for said R* is considered the optimal path,

if no, the optimal path does not exist for said limitations.

8. The method according to Claim [3] 1, comprising choosing an initial value of R in the range 0<R<1, thereby selecting a ratio between said relative importance weights ;

determining the cumulative value $MaxCTD_{cum}$ of the conditional shortest path for the selected ratio,

if the cumulative value $MaxCTD_{cum}$ does not exceed the required limitation $MaxCTD_{QoS}$, decreasing the selected value of R within said range,

if the cumulative value $MaxCTD_{cum}$ exceeds the required limitation $MaxCTD_{QoS}$, increasing the selected value of R within said range,

repeating the step of determining said $MaxCTD_{cum}$ up to either obtaining, at said particular value R*, the conditional path being said optimal path, or concluding that the optimal path does not exist.

9. The method according to Claim [3] 1, wherein values of R are selected in the following order:

selecting R=0;

if the cumulative value $MaxCTD_{cum}$ does not exceed the required limitation $MaxCTD_{QoS}$, considering the defined conditional shortest path to be optimal,

if the cumulative value $MaxCTD_{cum}$ exceeds the required limitation $MaxCTD_{QoS}$,

selecting R=1, and determining the cumulative value of $MaxCTD_{cum}$ for R=1;

if the cumulative value $MaxCTD_{path}$ still exceeds the required $maxCTD_{path}$, the optimal

path does not exist;

if the cumulative value $MaxCTD_{cum}$ for R=1 does not exceed the required limitation

$MaxCTD_{QoS}$, selecting a number of R values in the range 0<R<1, up to obtaining, at a particular

value R*, the cumulative value $MaxCTD_{cum}$ equal to, or smaller but substantially close to said

required $maxCTD_{QoS}$ parameter, thereby considering the conditional shortest path defined for

said R* to be the optimal path.

10. The method according to Claim 1, wherein said values of a ratio are selected by

applying a method of secants to a function $MaxCTD_{cum}$ =f(R), wherein said function being a

non-increasing monotonous function.

11. A method for optimized path selection in an <u>Asychronous Transfer Mode (ATM)</u>

network having a plurality of links where, for each of the links, Link State Parameters are

defined including a group of <u>non delay-oriented (non-D)</u> parameters comprising at least

<u>Administrative Weight (AW)</u>, and including two <u>delay oriented parameters (D-parameters)</u>

<u>Maximum Cell Transfer Delay (MaxCTD)</u> and <u>Cell Delay Variation (CDV)</u>, the method

comprises steps of:

obtaining two limitations of end-to end quality of service (QoS) parameters of the path to be selected between a source point and a destination point in said network, one of the limitations being Maximum Cell Transfer Delay (MaxCTD$_{QoS}$) and the other limitation being CDV$_{QoS}$,

selecting a value of minCDV such, that values of CDV parameter of the network links are substantially be represented as respective k-fold multiples of said minCDV, where k is integer;

building a virtual modified network from said network by virtually replacing each of the links, having CDV value of k*minCDV where k>1, with "k" fictitious component links each having the CDV value equal to said minCDV so, that the CDV value of each replaced link be equal to a cumulative value of corresponding CDV values of the "k" fictitious component links;

assigning to said "k" fictitious links values of remaining link state parameters in a manner providing equivalence of said "k" links to the replaced link from the point of each of the Link State Parameters;

defining an importance weight for the D-parameters as R, and that for the non-D parameters as (1-R);

sequentially selecting one or more R values in the range 0<R<1 and determining for each of them a cumulative value MaxCTD$_{cum}$ of a conditional shortest path in order to obtain, at a particular value R* of the importance weight R, the cumulative value MaxCTD$_{cum}$ equal to, or smaller but substantially close to said MaxCTD$_{QoS}$ limitation;

wherein the step of determining the cumulative value MaxCTD$_{cum}$ of the conditional shortest path comprises, for each selected value of R:

calculating a cost for each link of said modified network by using a weighed equation

comprising a first member, with importance weight R, reflecting influence of the D-parameter

MaxCTD on the cost, and a second member, with importance weight (1-R), reflecting influence

of said group of the non-D parameters on the cost;

applying a Bellman-Ford-type algorithm to the modified network represented by a

plurality of its links' costs, for defining said conditional shortest path between the source point

and the destination point, while limiting a number of links in said path to $H = CDV_{QoS}/minCDV$,

thereby obtaining the conditional shortest path both having a minimal sum of the cost values of

links forming said path, and satisfying the end-to-end limitation CDV_{QoS};

calculating said cumulative value $MaxCTD_{cum}$ of the conditional shortest path, by

summing maxCTD values of the links forming said path;

if said particular value R* exists, considering the corresponding to it said conditional shortest

path to be the optimal path.

12. A computer software product for selecting an optimal path in an <u>Asychronous</u>

<u>Transfer Mode (ATM)</u> network having a plurality of links where, for each of the links, Link

State Parameters are defined including a group of <u>non delay-oriented (non-D)</u> parameters

comprising:

at least <u>Administrative Weight (AW)</u>, and two <u>delay oriented parameters (D-parameters)</u>

being <u>Maximum Cell Transfer Delay (MaxCTD)</u> and <u>Cell Delay Variation (CDV)</u>, and said

ATM network being represented in the form of a network database;

the product comprising a computer-readable medium in which program instructions are stored, which instructions, when read by a computer, cause the computer to:

obtain, from a request on selecting a path between a source point and a destination point in said network, two limitations of end-to end quality of service QoS parameters of the path to be selected, one of the limitations being $MaxCTD_{QoS}$ and the other limitation being CDV_{QoS},

normalize the D-parameter CDV by modifying the ATM network so as to make CDV constant for all links of the modified network, thereby forming a modified network database;

activate a subroutine of a link cost equation comprising a first member reflecting influence of the D-parameter MaxCTD on the cost, and a second member reflecting influence of the group of non-D parameters on the cost, the members being taken with respective relative importance weights,

using said link cost equation subroutine, calculate links' costs of the modified network, for one or more values of a ratio between the relative importance weight of the first member and that of the second member, and form a data base of link costs (cost DB) for each of said one or more ratio values;

apply a subroutine of a shortest path algorithm to each of the formed cost DBs to determine one or more conditional paths for said one or more cost DBs respectively, said algorithm being capable of selecting a minimal cost path among paths limited by a given number of links to satisfy said limitation CDV_{QoS};

calculate one or more cumulative values $MaxCTD_{cum}$ of the D-parameter MaxCTD for said respective one or more determined conditional paths, and

make a judgment about the optimal path, based on comparing said one or more

cumulative values $MaxCTD_{cum}$ with the limitation $MaxCTD_{QoS}$.

13. A method for selecting an optimal path in an <u>Asychronous Transfer Mode</u>

<u>(ATM) network</u> having a plurality of links where, for each of the links, Link State Parameters are

defined at least two <u>delay oriented parameters (D-parameters)</u> being <u>Maximum Cell Transfer</u>

<u>Delay (MaxCTD)</u> and <u>Cell Delay Variation (CDV)</u>, the method comprising the following steps:

a) obtaining two limitations of end-to end <u>quality of service (QoS)</u> parameters of the path

to be selected in the network between a source point and a destination point, one of the

limitations being $MaxCTD_{QoS}$ and the other limitation being CDV_{QoS},

b) normalizing a D-parameter CDV by virtually modifying the ATM network so as to

make CDV constant for all links of the modified network, by

selecting a value of minCDV such, that values of CDV parameter of the network links are

substantially represented as respective k-fold multiples of said minCDV, where k is integer;

building a modified network by virtually replacing each of the links, having CDV value

of k*minCDV where k>1, with "k" fictitious component links each having the CDV value

equal to said minCDV so, that the CDV value of each replaced link be equal to a cumulative

value of corresponding CDV values of the "k" fictitious component links;

assigning to said "k" fictitious links values of remaining Link State Parameters in a

manner providing equivalence of said "k" links to the replaced link from the point of each of the

link state parameters;

c) constructing at least one link cost equation reflecting influence of ~~the~~ a D-parameter MaxCTD on the cost,

d) based on said at least one link cost equation, calculating links' costs of the modified network, and forming one or more data bases of link costs;

e) applying a Bellman-Ford-type shortest path algorithm to each of the one or more formed data bases to determine one or more conditional paths for the respective one or more data bases, said algorithm being capable of selecting a minimal cost path among paths limited by a given number of links to satisfy said limitation CDV_{QoS};

f) calculating one or more cumulative values $MaxCTD_{cum}$ of the D-parameter MaxCTD for said respective one or more determined conditional paths, and

g) making a judgment about the optimal path, based on comparing said one or more cumulative values $MaxCTD_{cum}$ with the limitation $MaxCTD_{QoS}$, said optimal path being such of said one or more determined conditional paths, satisfying both the limitation CDV_{QoS} and the limitation $MaxCTD_{QoS}$.

Allowable Subject Matter

4.   Claims 1, 4-13 are allowed.

Reasons for Allowance

5.   The present invention is directed to a method and software product for selecting an optimal path selection in an ATM network. The closest prior art, Kataria et al. (U.S.

6,657,229) disclose a methods for improving the probability of finding a connection path in a Quality of service based path selection, fail to anticipate or render the above limitations obvious, furthermore, Kataria et al. does not show normalization of any QoS parameter and does not use the Bellman-Ford algorithm for modified metrics.

6.   Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

7.   Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeffrey C. Pwu whose telephone number is 571-272-6798. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov.

May 20, 2005

JEFFREY PWU
PRIMARY EXAMINER